MECHATRONICS

Varsha Degaonkar

Gyroscope frame

Spin axis

GYROSCOPE

Gimbal

Rotor

Introduction

Gyroscope

- Used for navigation

- Used for measuring angular velocity.

- rotational velocity can be measured in 1, 2, or 3 directions.

- 3 axis gyroscopes can provide a full 6 degree-of-freedom in motion tracking system with a 3-axis accelerometer

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Principle of Operation

- Orientation is determined with use of Earth's gravity

- Evolved from mechanical-inertial spinning devices which consists of rotors, axles, and gimbals

- Types of gyroscopes:

    a) Rotary (classical) gyroscope

    b) Vibrating Structure Gyroscope

    c) Optical Gyroscope

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Rotary (classical) Gyroscopes

- The law of conservation of angular momentum is used in the Rotary (classical) gyroscope. Which says that system will get constant angular momentum in direction and magnitude if the system has zero the resultant external torque .

- It consists of : spinning disk or mass on axle, a series of gimbals

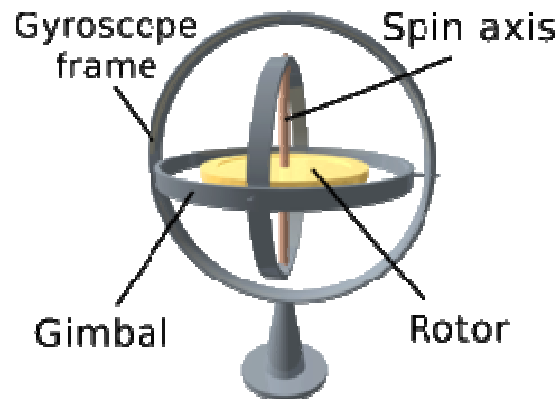- Additional degree of rotational freedom is given by gimbals.

Fig. 1 Rotary Gyroscope (https://en.wikipedia.org/wiki/Gyroscope)

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Vibrating Structure Gyroscopes

- Vibrating structure gyroscopes are MEMS (Micro-machined Electro-Mechanical Systems) devices

- The operation uses principle of Coriolis force.

- The Coriolis force is proportional to both the angular velocity of the rotating object and the velocity of the object moving towards or away from the axis of rotation.

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Specifications

- Measurement range
- Number of sensing axes
- Nonlinearity
- Working temperature range
- Shock Survivability
- Bias Instability
- Angular Random Walk (ARW
- Bias
- Bias Drift
- Bandwidth

Selection Criteria

- Nonlinearity
- Noise density
- Bias repeatability
- Acceleration sensitivity
- Sensitivity to vibration
- Sensitivity to linear acceleration–or g sensitivity
- Environmental Factors- Temperature
- Availability
- Cost

THANK YOU!!

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